



BOOK OF ABSTRACT

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I. SESSION DESCRIPTION

ID: B3

Semi natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

	Title	Name	Organisation	E-mail
Host:	Dr.	Alessandro Gimona	JHI, UK	Alessandro.gimona@hutton.ac.uk
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Co-host(s):	Dr.	Sandra Luque	IRSTEA, FR	sandra.luque@irstea.fr
	Dr.	Paola Ovando Pol	JHI, UK	Paola.OvandoPol@hutton.ac.uk
	Dr.	Miguel Bugalho	CEA, PT	migbugalho@isa.ulisboa.pt

Abstract:

Conserving and enhancing ecosystem function and services is crucial for sustainable development at a local, national and global level. There is international scientific consensus that, in order to achieve the relevant Sustainable Development Goals (SDGs), it is necessary to integrate forest ecosystem services into spatially explicit decision-making, and to consider trade-offs. This would ensure that forest resources and the ecosystem services that flow from them, remain available and well managed, thus enhancing human well-being and biodiversity. Knowledge of the spatial distribution and entity of forests and their condition is a necessary first step to address the need for resilient and sustainable forested landscapes and their services. It is also important to better understand trade-offs between benefits and potential disservices, for example when forest plantations are involved. A range of ecosystem services are related to forest characteristics, such as community and species distribution, plant traits, biomass and carbon storage, prevention of erosion and diffuse pollution. Earth Observation technology is becoming a fundamental tool for mapping and monitoring forest ecosystems and can be integrated with modelling and scenario approaches to inform on a range of



ecosystem services and on their potential future trends, especially in the light of projected climatic change. We welcome contributions studying both seminatural forests and forest plantations, their spatial distribution and their trade-offs. The following types of contributions are particularly welcome: contributions focussing on cultural ecosystem services; those making use of new technology to describe and monitor the present state; contributions making use of models and scenarios to project potential shifts in the future provision of services.

Goals and objectives of the session:

The goal of the session is to advance the assessment of ecosystem services and disservices provided by seminatural forests and forest plantations and their trade-offs, especially in the face of land use and climate change.

This session is twinned with session D8e, "Improving conservation targets for forest biodiversity: towards operational solutions from remote sensing technology" of the IUFRO World Congress in Curitiba – Brazil, October 2019

Planned output / Deliverables:

If there is enough interest, a joint research proposal and the writing of a common article will be promoted.

Related to ESP Working Group/National Network:

[Biome working group: BWG 3 – Forests & Woodlands](#)



II. SESSION PROGRAM

Date of session: Thursday, 24 October 2019

Time of session: 10:30 - 15:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
10:30– 10:35	Alessandro	Gimona	The James Hutton Institute (UK)	Introduction to the session
10:35– 10:50	Rositsa	Yaneva	Forest Research Institute – Bulgarian Academy of Sciences	Mapping the capacity of forest ecosystems to mediate toxic elements
10:50– 11:05	Karla	Locher– Krause	Helmholtz Centre for Environmental Research – UFZ (Germany)	Ecosystem services and disservices: the case of exotic forest plantations in Southern Chile
11:05– 11:20	Ashley	Hardaker	Bangor University (UK)	Land sharing or land sparing for trees within upland agricultural land use, what's the way forward?
11:20– 12:00				GENERAL DISCUSSION
		LUNCH– BREAK		
13:30– 13:40	Edgars	Jūrmalis	LSFRI "Silava" (Latvia)	Mapping the potential supply of multiple recreational services in Latvian forests
13:40– 13:50	Mario	Torralba	University of Kassel (Germany)	Providing cultural ecosystem services from Europe's forests
13:50– 14:00	Yujin	Shin	National Institute of Forest Science, Korea Forest Service, Korea, Republic Of	Integrating Ecosystem Services to assess the influence of ecological forest management: A case study in Mt. Gariwang

Time	First name	Surname	Organization	Title of presentation
14:00– 14:10	Claudio	Petucco	Luxembourg Institute of Science and Technology	Multisilva: A decision support tool to enhance the provision of forest ecosystem services
14:10– 14:20	Amelie	Robert	CNRS	Concluding remarks
14:20– 15:00				GENERAL DISCUSSION

III. ABSTRACTS

The abstracts appear in alphabetic order based on the last name of the first author. The first author is the presenting author unless indicated otherwise.

1. Type of submission: **Abstract**

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Land sharing or land sparing for trees within upland agricultural land use, what's the way forward? An analysis of the changes to the economic value of ecosystem service benefits and ecosystem dis-service costs from upland land use in Wales following expan

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Increases in tree cover on upland agricultural land in Wales is a politically desirable way to sequester carbon and enhance regulating ecosystem services. In this study we used economic valuation to assess the impact of tree cover expansion on the economic value of ecosystem service and dis-services from upland land use in Wales. We also used GIS to analyse and map the spatial distribution of ecosystem service benefits and dis-service costs from expansion of



tree cover. Our results provide an initial assessment of the impacts of tree cover expansion on the economic value of ecosystem services dis-services from upland land use in Wales. Our economic valuation shows that land sparing options— particularly full afforestation with broadleaves—led to the greatest increase in the economic value of ecosystem service benefits (+£39,500.78million) and reduction ecosystem dis-service costs (–£663.73million) over business as usual. However, these options significantly reduce provisioning (livestock production and arable crops) ecosystem services (–£10,986.24million, 6% of business as usual). In contrast, land sharing options—particularly the establishment of broadleaf farm woodlands—provide a better balance by maintaining a level of food production (53% of business as usual) alongside significant increases in other ecosystem service categories (£14,637.14million increase in net ecosystem service benefits and delivery of 8 out of 9 ecosystem service categories). Whilst increasing tree cover was generally positive there were distinct differences between broadleaf and conifer planting. Broadleaf systems (including various forms of farm woodland and agroforestry) reduced ecosystem dis-service costs across the entirety of the Welsh uplands whereas conifers did not. Overall our results suggest that land sharing options for tree cover expansion are best by providing balanced increases in ecosystem services and reduction in dis-services.

Keywords: Agriculture, Tree Cover, Land Sparing/Sharing, Ecosystem Service Assessment, Economic Valuation

2. *Type of submission: Abstract*

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Mapping the potential supply of multiple recreational services in Latvian forests

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Forest ecosystems are important places of provision of multiple cultural ecosystem services, including recreational activities. Hunting and orienteering are among popular recreational activities in Latvia. Research concerning recreational ecosystem service flows, demands and



provision is limited and spatial preferences for accounting the quality of the services is lacking. Mapping ecosystem services, even the non-tangible ones, is a crucial task for improving practical forest planning and increasing the multifunctional use of forest areas.

We conducted a basic, GIS based multicriteria analysis to assess the provision of both ecosystem services in a managed forest area. Several experts from both fields of recreation were selected to assess pre-defined criteria and to propose their own for valuing potential supply of both services. Geospatial data was converted and used to create the selected criteria layers. Ecosystem service provision maps were created from the multicriteria analysis results, showcasing different preferences between the two recreational activities. The results can be used to further assess and discuss the importance of different values and preferences across the broad range of recreational activities, both in the context of planning relevant forestry actions or by assessing potential overlaps or trade-offs in a forest landscape. Our use of expert opinions shows potential in gaining a broad sense of preferred forest structures and other factors, although subjectivity can be considered as a potential drawback.

Keywords: cultural ecosystem services, spatial analysis, expert opinions, forest multifunctionality

3. *Type of submission: Abstract*

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Ecosystem services and disservices: the case of exotic forest plantations in Southern Chile

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Forest ecosystems have a crucial role in providing multiple services by supporting biodiversity maintenance, conservation as well as the functions crucial for human wellbeing. Natural forests, semi-natural forest and forest plantations (in our case study with exotic species)



broadly differ in the type and quantity of ecosystem services supply. The drastic increase of industrial forest plantations, particularly in subtropical areas, lead to a diverse range of impacts in the availability of these systems to provide support for local communities. This is the case of Chile in which the forestry industry rapidly expanded due to internal economic incentives leading to a large transformation of natural ecosystems and the most important driver of deforestation in the country. Despite these environmental impacts, the industrial forestry sector is one of the most important economic activities of the country, representing 14% of its total export. Hence this study identifies, map and quantify services and disservices of exotic forest plantation in Southern Chile. We investigated selected forest ecosystem services (carbon storage, sediment retention, phosphorous retention, plantation productivity, landscape aesthetics, and forest recreation) and its disservices over time (1985 – 2011), based on remote sensing information and spatially explicit models (i.e., InVEST). Our results indicate a mismatch between the supply of services/disservices related to its beneficiaries, emphasizing the trade-off between them across the landscape and over time. We provide evidence that contributes to the understanding of the role of exotic forest plantation in the area. This information could support better landscape planning seeking to enhance the supply and flow of ecosystem services in highly transformed landscapes.

Keywords: Forest ecosystem services, disservices, landscape planning, ecosystem service supply, beneficiaries, Southern Chile.

4. *Type of submission:* **Abstract**

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Multisiva: A decision support tool to enhance the provision of forest ecosystem services

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Payment for ecosystem services (PES) are raising attention as a tool to enhance the provision of forest ecosystem services. These schemes often focus on changing forest management practices to enhance the provision of ecosystem services. This work focuses on two important



challenges concerning the implementation PES schemes: firstly, it tackles the high level of complexity involved in forest ecosystems and hence the lack of quantitative assessment of the ecosystem services provision under different management regimes; secondly, it addresses the quantification of the direct and indirect costs of changing the management practices. This work additionally focuses on the development of a decision support tool prototype, MULTISILVA, which tries to quantify these two crucial aspects. The tool is based on an a forest growth simulator (3-PG Forest Growth Model), which was adapted and extended to accommodate a set of common management practices used to improve ecosystem services at the stand level (e.g. promotion of broadleaved species, set aside areas, increase of deadwood). By combining these practices, it is possible to define and simulate a set of management alternatives, calibrated for central European species, over a given time horizon. The tool provides ecosystem services indicators (e.g. timber provision, carbon sequestration, water infiltration, air purification, recreation) for the simulated management alternatives. In addition, the tool is able to compute the direct costs as well as the opportunity cost for each alternative, with reference to pre-defined business as usual scenario. The functionalities of the tool are illustrated simulating different management alternatives for a pine forest in Luxembourg.

Keywords: Forest ecosystem services, decision support tool, forest simulator, cost of provision, opportunity cost

5. *Type of submission: Abstract*

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Integrating Ecosystem Service to assess the influence of ecological forest management: A case study in Mt. Gariwang

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The concept of ecosystem service (ES) highlights the diverse values of the ecosystem; from primary production to recreational function of ecosystem. ES is very useful criteria to evaluate the value of ecosystem itself. Forest ecosystem is crucial to support about one quarter of terrestrial biodiversity, with nearly half of the world's biodiversity hot spots. To enhance forest



ecological functions and ecosystem services, several methods such as thinning are suggested. Forest management could derive unexpected changes in ecosystem; therefore, assessing the trade-offs of the management in aspect of ES is necessary. The study site, Gariwang mountain is model forest for ecological forest management in Korea and several forest management activities including thinning were widely conducted since 1990s. Firstly, the twenty three indicators representing forest ecosystem services (FES) were identified corresponding to the study site, and measurable FES indicators were selected and investigated from 2011. The current states of FES indicator such as water quantity and quality, mushroom, air quality regulation, cultural-heritage spots and recreational-aesthetic wild flower were measured. Then, changes in FES indicators following thinning including biomass, carbon storage, biodiversity, habitat quality and micro-climate were investigated. For example, Mt. Gariwang provides 1.9 million tons of fresh water per year. 372 species of mushroom, 667 species of vegetation, 19 species of fauna and 69 species of birds inhabited. The wild flower has \$3,541 per year of economic value. Annual increase in biomass of *Larix kaempferi* in thinned area increased 1.7~2.3 times higher than unthinned area 3 years after treatment. Our study showed that several indicators have potential to be applied for assessment of forest management in aspects of ES. Next step is to develop ES valuation methods suitable for our data. It ultimately could suggest the ecological forest management policy for sustainable ecosystem services.

Keywords: Forest, Ecosystem service, Ecological management, Thinning, Policy



6. *Type of submission: Abstract*

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Providing cultural ecosystem services from Europe's forest: Examining the relevance of cultural ecosystem services and potential for multifunctionality in European forests

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The ecosystem service (ES) framework has become one of the most important paradigms in forest planning and management as a way to link the multiple provisioning, regulating and cultural services derived from ecosystems and their benefits to human well-being. In the more recent years, there have been multiple efforts in emphasizing the important the non-material values related to regulating and cultural services in relation to provisioning services. However, the consideration of non-material values and cultural ecosystem services in management models remains a challenge. In the current context of increased demand for the joint provision of multiple ecosystem services (multifunctionality), we aim to evaluate which forest ecosystem services are currently promoted by European landowners, what is the potential for further uptake and which factors support or hinder this processes. Through a survey to of 1182 forest landowners from 25 European countries our findings reveal a high diversity of management models and a general positive attitude towards further provision of cultural ecosystem services. There is a high degree of complementarity between the different services, and many of them could be jointly promoted. Our results further suggest the existence of four differentiated types of landowners based on the current degree and potential implementation of a diversified management and offer of products and activities. These groups differ in the types of facilities in place and supporting management actions; but also with regard to the challenges and barriers they perceive. This diverse perspectives amongst Europe's landowners suggest the need for different strategies to promote management models that boosts multifunctionality in European forests: while in some cases the best strategy would be to facilitate supporting measures, in others direct incentives would be more successful.



Keywords: Non-material values, Multifunctionality, Barriers and limitations

7. *Type of submission: Abstract*

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Mapping the capacity of forest ecosystems from sredna stara planina mountain to mediate toxic elements

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Forest ecosystems are known for the provision of various ecosystem services and by the terrestrial biodiversity abundance provided. Forests have high capacity to filter contaminants and to reduce the concentrations of potential toxic elements (PTEs), transported by the air at long distances. In this paper, we analyze the capacity of selected ecosystems to mediate the transfer of PTEs by investigating its concentrations in the soil-plant system in relatively clean environment of Sredna Stara Planina Mountain. The forest patterns and soil properties play an important role as changes in land cover / land use patterns over time define the carbon accumulation in forest ecosystems. The methodology applied integrates sampling, laboratory analysis and GIS in order to overlay data and to assess and map this regulating ecosystem service of forest ecosystems. The ecosystem services and indicators related are based on the Common International Classification of Ecosystem Services (CICES) referred to the specific biochemical and physical inputs. The final results represent maps of the capacity of forest ecosystems to provide ecosystem services and visualize the distribution of toxic elements in the representative regions from Sredna Stara Planina Mountain. This approach can be successfully integrated into regional forest investigations and thus, has potential to contribute to the forest management practices and improve the overall environmental condition.

Keywords: forests, PTEs, ecosystem services, mapping